CLAIMS

1. A gas distribution plate for use in a semiconductor fabrication apparatus including a semiconductor processing chamber, the gas distribution plate comprising:

a plurality of holes for passing process gases to the semiconductor processing chamber; and

a portion having substantially consistent reactivity to the process chemistry used in the semiconductor fabrication apparatus over the entire operating life of the gas distribution plate.

2. A gas distribution plate as recited in claim 1 wherein the portion of the gas distribution plate is rendered substantially non-reactive by reducing the defects on the portion before implementation within the semiconductor fabrication apparatus.

3. A gas distribution plate as recited in claim 1 wherein the portion of the gas distribution plate is rendered substantially non-reactive by heating the portion.

4. A gas distribution plate as recited in claim 1 wherein the portion includes at least one surface of the distribution plate which is exposed to the internal regions of the semiconductor processing chamber.

5. A gas distribution plate as recited in claim 1 wherein, during its operation, the gas distribution plate always produces less than 0.1 defect particles per square centimeter for a wafer processed in the semiconductor fabrication apparatus.

6. A gas distribution plate as recited in claim 1 wherein the gas distribution plate does not substantially diminish wafer yield over the entire operating life of the gas distribution plate.

7. A gas distribution plate as recited in claim 6 wherein the at least one distribution groove is machined to a back face of the gas distribution plate.

8. The gas distribution plate as recited in claim 1 wherein the gas distribution plate includes a material whose products from reacting with the process chemistry used in the plasma processing chamber are gaseous.

9. The gas distribution plate as recited in claim 1 wherein the gas distribution plate includes a ceramic material.

10. A gas distribution plate as recited in claim 9 wherein the plate includes one of Si_3N_4, Al_2O_3 , AlN and SiC.

11. A gas distribution plate as recited in claim 9 wherein the ceramic material is included in a portion of the gas distribution plate which faces the semiconductor processing chamber.

12. A plasma-based fabrication apparatus, comprising:

a plasma chamber that receives process gases and forms a plasma therefrom; and

a gas distribution plate including a plurality of holes that supply the process gases into said plasma chamber, a portion of said gas distribution plate being substantially non-reactive with the process chemistry used in said plasma chamber over the entire operating life of said gas distribution plate.

13. A plasma-based fabrication apparatus as recited in claim 11 wherein said plasma-based fabrication apparatus fabricates semiconductor devices.

14. A plasma-based fabrication apparatus as recited in claim 11 wherein said plasma-based fabrication apparatus is a semiconductor etch machine.

15. A plasma-based fabrication apparatus as recited in claim 11 wherein said gas distribution plate is pretreated by heating so as to be substantially non-reactive with the process chemistry over the entire operating life of said gas distribution plate.

16. A plasma-based fabrication apparatus as recited in claim 15 wherein said heating occurs at a controlled temperature for a prolonged time.

17. A plasma-based fabrication apparatus as recited in claim 16 wherein the controlled temperature is between about 1500 degrees Celsius to 1600 degrees Celsius.

18. A plasma-based fabrication apparatus as recited in claim 15 wherein the prolonged time is from about 5 to 10 hours.

19. A method of making a gas distribution plate for use in a plasma processing apparatus, said method comprising:

machining a material to form the gas distribution plate; and

subsequently heating at least a portion of the gas distribution plate.

20. A method as recited in claim 19 wherein the material includes a ceramic.

21. A method as recited in claim 20 wherein the material includes Si_3N_4.

22. A method as recited in claim 19 wherein said heating occurs at a controlled temperature for a prolonged time.

23. A method as recited in claim 22 wherein the controlled temperature is between about 1500 degrees Celsius to 1600 degrees Celsius.

24. A method as recited in claim 22 wherein the prolonged time is from about 5 to 10 hours.

25. A method as recited in claim 24 wherein the controlled temperature is between about 1500 degrees Celsius to 1600 degrees Celsius.

26. A method as recited in claim 19 wherein said machining includes grinding the material.

27. A method as recited in claim 19 wherein machining includes drilling holes in the material.

28. A method as recited in claim 19 wherein said method further includes:

refinishing at least a section of the gas distribution plate following said heating.

29. A method of making a gas distribution plate for use in a plasma processing apparatus, the method comprising:

grinding a material at a first stage of material removal to shape the gas distribution plate;

drilling holes in the gas distribution plate to facilitate gas distribution during use;

grinding one or more surfaces of the gas distribution plate at a second stage of material removal; and

heating at least a portion of the gas distribution plate.

30. A method as recited in claim 29 wherein the material is a composite.

31. A method as recited in claim 29 wherein the method further comprises:

machining the gas distribution plate after heating to fit one or more tolerances.

32. A method as recited in claim 29 wherein the portion of the gas distribution plate is rendered substantially non-reactive by smoothing the portion before implementation within the semiconductor fabrication apparatus.

33. A method as recited in claim 29,

wherein the grinding during the first stage is course grinding, and

wherein the grinding during the second stage is fine grinding.

34. A method as recited in claim 29 wherein grinding at a first stage includes forming a contour.

35. A method of improving the performance of a gas distribution plate for use in a semiconductor fabrication apparatus, the method comprising pretreating at least a portion of the gas distribution plate before using the gas distribution plate in the semiconductor fabrication apparatus, wherein the pretreating reduces the reactivity of the gas distribution plate with process chemistry used in the semiconductor fabrication apparatus.

36. A method as recited in claim 35 wherein the pretreating includes heating at least the portion of the gas distribution plate.

37. A method as recited in claim 35 wherein the pretreating serves to smooth at least a surface of the gas distribution plate exposed to a plasma processing chamber included in the semiconductor fabrication apparatus.

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